



View of lagoons



Wetland cells



Sunken wetland cell



View towards discharge point

Silt Facility Statistics	
Nearest Town:	Silt
County:	Garfield
River Basin:	Lower Colorado
Receiving Water Body:	Colorado River
Year Online:	1992
Population:	1700
Elevation (feet):	5700
Design Flow (mgd):	0.236
Average Flow (mgd):	0.110
Size (acres):	0.83

Facility Description

The Silt wastewater treatment facility is a domestic minor municipal lagoon system. The system consists of influent Parshall flume for flow monitoring, two aerated lagoons, a polishing pond, surface flow constructed wetlands, chlorine gas disinfection, and a V-notch weir for effluent flow monitoring.

Lagoons

Silt operates a 3-lagoon system. The first cell is a shallow (5') aerated cell, with 4 – 5hp aerators. The second cell is aerated with 3 – 5hp aerators. The third cell is used as a polishing pond. Piping is provided to allow subsurface flow between the cells. However, surface transfers have been observed. Excessive algae growth has been experienced in the lagoon. Operators have attempted to alter the effluent piping to avoid algae, installed a fabric liner on the lagoon surface to prevent sunlight penetration, and most recently introduced duckweed into the lagoon cells.

Background Information

In February 1991 Silt was given a Notice of Violation and Cease and Desist Order. In 1992 a 0.85 acre constructed wetland was added to assist with algae removal from the shallow, 5-foot deep, 57-day detention time lagoons. The wetlands have experienced performance problems leading to ongoing compliance difficulties for Silt. Problems with the wetland have included an unintended plumbing by-pass from lagoons directly to the chlorine contact chamber, piping from lagoons pulling from surface of water, large areas of the wetland cells not filled in with vegetation and muskrat damage. In November 1999 the CDPHE issued a Notice of Significant Noncompliance for failing to meet BOD and TSS limitations, as well as failure to repair / replace their flow measuring devices. At the time of the site visit, Silt was in noncompliance.

Energy Analysis

The wastewater flows through the Silt system by gravity. The aerated lagoons utilize 7 – 5hp submersible aerators. The aerators run 24 hours a day, 7 days a week. Energy costs at this site are approximately \$1800 per month.

Wetland Design

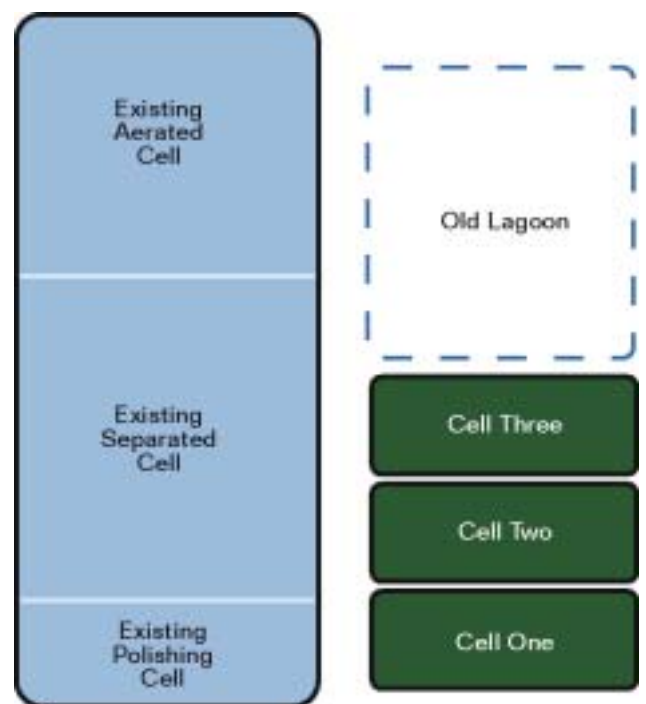
Design Methods

The Silt facility has one of the older treatment wetlands in Colorado. It was determined that a surface flow constructed wetland was the best option for this site because land was available and cost could be minimized by utilizing City crews to perform the earthwork. The wetlands were sized to

Objectives

This site has had ongoing problems with excessive BOD and TSS effluent from their shallow lagoon system.

Size



The wetland system consists of three wetland cells that are approximately 120' by 100'. The total surface area for all three cells is 0.83 acres.

Shape

The wetland cells are rectangular, with an aspect ratio of 1.2:1. The flow path is direct.

Hydraulics

The original hydraulic design of this system included a 'step-feed' distributor as a part of the influent system. Introducing the wastewater in this manner distributes the wastewater more uniformly across the wetland surface area than a typical header distributor pipe. Silt found that more detention time was needed in the wetland, and subsequently, changed the influent to the distributor pipe at the head of each wetland cell.

A splitter box is provided to allow the lagoon effluent to bypass the wetland cells. Adjusting the v-notch weir at the inlet controls water level in the wetland.

The wetland cells were originally designed to be able to be dewatered. Unfortunately, the bed of the wetland cells sank about 18" due to the weight of the wetland media, vegetation and water. This resulted in areas within the wetland that cannot be dewatered. Pea gravel was added to two of the cells in order to raise the ground level and allow plant establishment. The third cell was not easily accessible, and the addition of gravel was not feasible. It has standing water and large, unvegetated areas.

A pvc liner is provided in the wetland cells to prevent groundwater interactions.

Treatment Goals

Permitted Discharge Limitations	
Oil and Grease:	10 mg/l (Daily Max)
BOD ₅ :	30 mg/l (30-day ave)
BOD ₅ Removal:	85%
TSS:	75 mg/l (30-day ave)
PH, su (min – max)	6.0 – 9.0 (Daily Max)
Chlorine Residual:	0.5 mg/l (Daily Max)
Fecal Coliform Bacteria:	6,000 organisms per 100 ml (Daily Max)

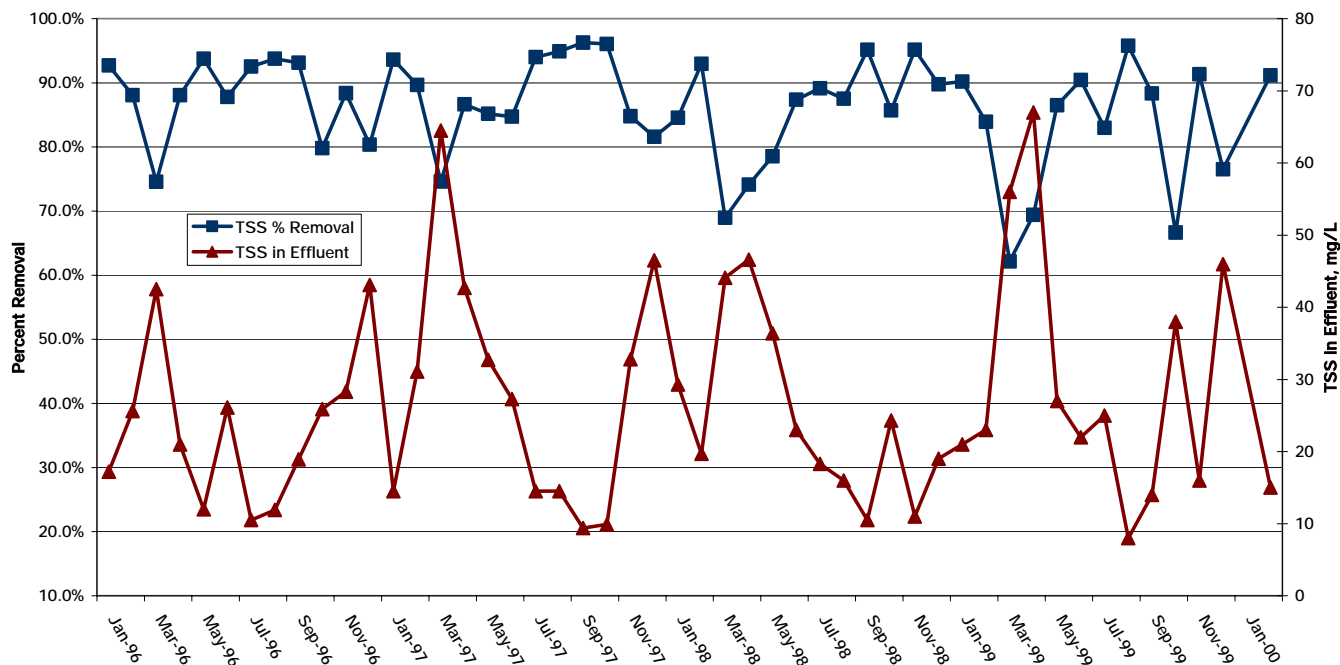
Water Quality Data

TSS Data

The TSS graph plots the percent removal on the left axis and TSS in mg/l in the effluent on the right axis. The average monthly TSS in the influent, during the period of record, has been 202 mg/l and the average monthly effluent has been 27 mg/l. This meets the permit discharge requirement of 75 mg/l.

Silt TSS Performance

Wetlands Completed November 1992

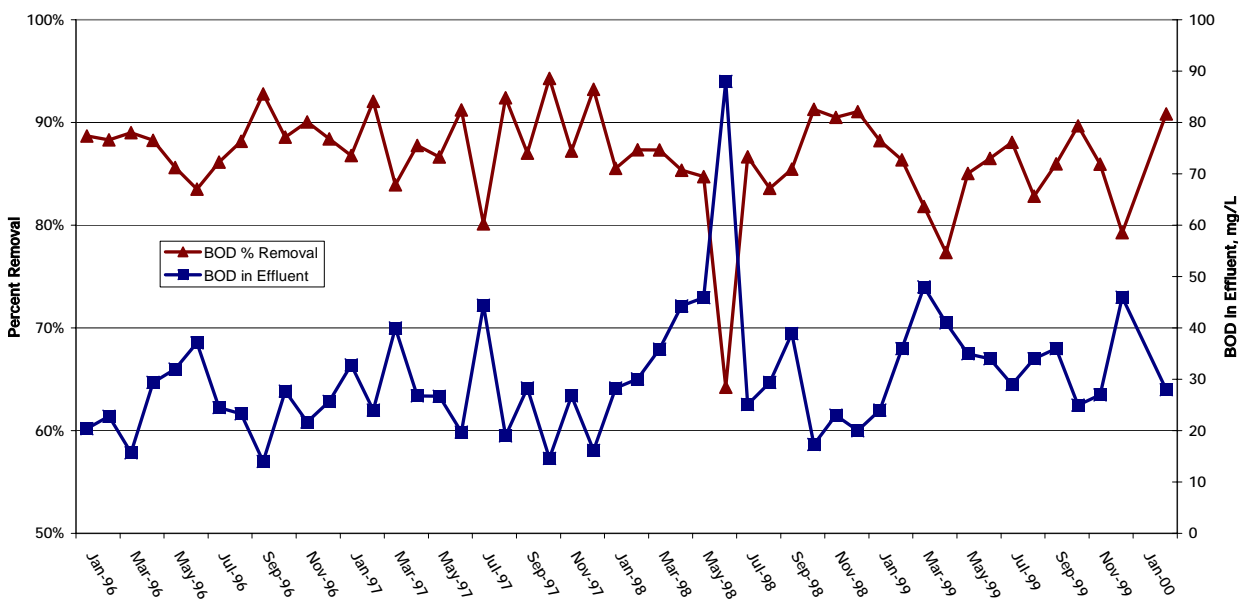


BOD Data

The BOD data is plotted similarly to the TSS data, with mg/l in the effluent on the right axis, and percent removal on the left axis. . The average monthly influent amount has been 229 mg/l and the average monthly effluent amount has been 30 mg/l. Several exceedances of the permit limitation have been experienced.

Silt BOD Performance

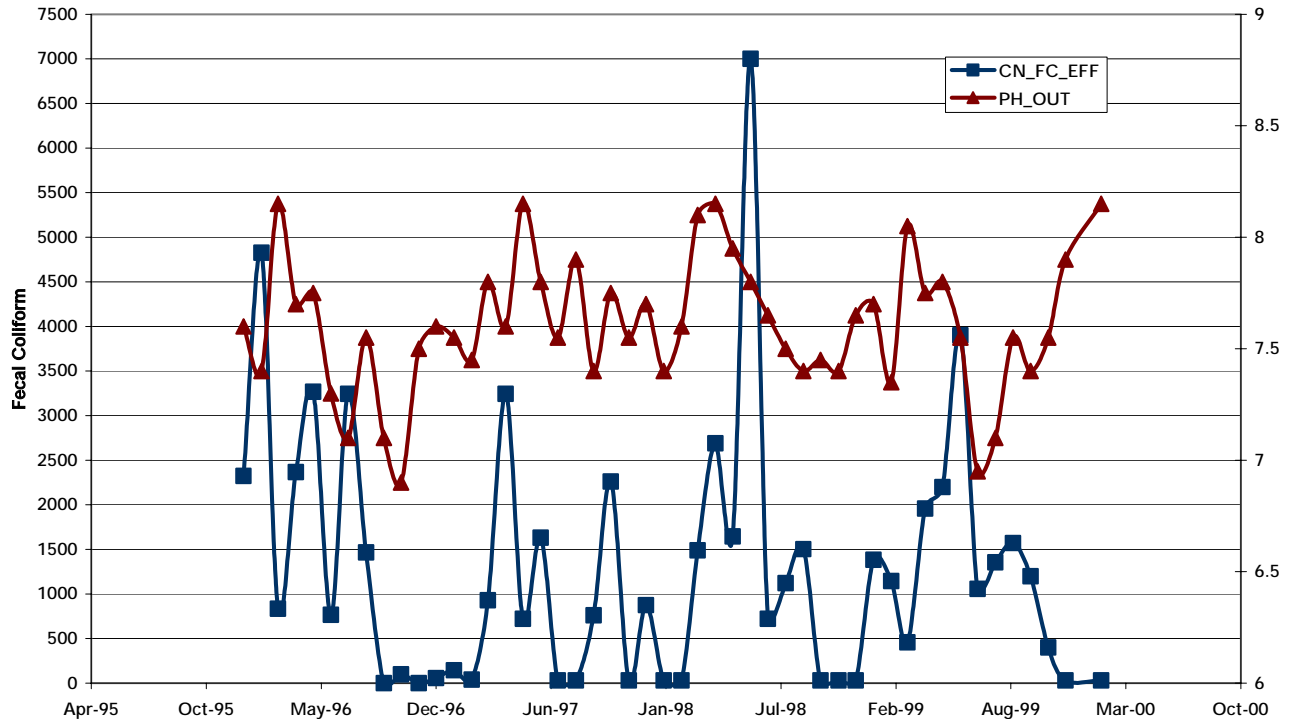
Wetlands Completed November 1992



pH and Fecal Coliform

Data for these two categories have been plotted on the same graph. Data reflect the quality of the effluent; no influent measurements are taken for these parameters. The pH values plotted are an average of the minimum and maximum 30-day values that are reported in the monthly reports. During the period of record, pH values have consistently stayed within the allowable range of 6.5 to 9.

Silt pH and FC in Effluent



General Ecological Setting

The Colorado River corridor in the Silt area contains a number of diverse wetland and riparian communities that occur on islands, point bars, and along the banks. Much of the vegetation along the river has been altered. The land now supports landscape along the irrigated agricultural areas including most row crops, irrigated pastureland and hay fields and associated farm or ranch facilities.

Cell Vegetation

The dominant species in all three cells are cattail (*Typha latifolia*) and duckweed (*Lemna minor*). Cell 1 has a 50 percent cattail/50 percent duckweed cover. Cell 2 is 80 percent duckweed and 20 percent cattail, and cell 3 is 80 percent cattail and 20 percent duckweed. All three cells have traces of curly dock (*Rumex crispus*), lady's thumb (*Polygonum persicaria*), yellow sweet clover (*Melilotus officinale*), and tamarisk (*Tamarix chinensis*).

Planting/Seeding

Cattails were harvested from adjacent areas and planted during the spring.

Weeds

Tamarisk is a State Noxious Weed. Impacts of tamarisk include: (1) dewatering of sites; (2) crowding out native species causing a loss of biodiversity; and (3) providing less habitat values compared to functioning riparian areas with native species.

Maintenance Issues

One cell was burned in the spring to remove aboveground cattail biomass. Duckweed needs to be harvested annually before the first frost.

A short-circuiting in the system was allowing a substantial portion of the discharge to go directly to the chlorine contact chamber without passing through the wetlands.

Wildlife

The constructed wetland does not add significantly to habitat otherwise present in the immediate area. The Colorado River system supports flora and fauna of the area. Waterfowl, songbirds, small mammals, amphibians, and reptiles may use the constructed wetland. The general wildlife habitat and habitat diversity were low to moderate in value. Total functional points were 46% of the total possible, and it rated as a category III wetland.

Muskrats tunneled into berms, cut vegetation and made muskrat lodges. The community retained a local trapper and it was estimated that there might have been 30 to 40 animals present in the wetlands. The Town staff replaced the fill on the berms and placed wire mesh rodent barrier on the top and flanks of the berms. A raptor perch was also constructed on the edge of the wetlands to encourage owls, hawks and eagles to control the muskrat population.

Wetland Biodiversity Functional Assessment

Wetland biodiversity functional assessment.		
Function and Value Variables	Functional Points (0.1 to 1)	Possible Points
General Wildlife Habitat	0.5 (mod.)	1
General Fish/Aquatic Habitat	0.0	1
Production Export/Food Chain Support	0.4 (low)	1
Habitat Diversity	0.2 (low)	1
Uniqueness	0.2 (low)	1
Total Points	2.3 (46%)	5
Wetland Category (I, II, III, or IV)	III	-

Human Use

The wastewater wetland is part of a restricted public access area, and has never been used for educational purposes. This wetland has moderate aesthetic value. It has good vegetation cover.

Overall Site Comments

The wetland at the Silt facility has not functioned as intended. In part, this is because the wetland cells were not constructed in accordance with the approved design plans. The wetland cells bottoms were found to be uneven, short-circuiting problems due to plumbing went unchecked, and the sinking of the wetland led to excessive water depth in the cells.